Amendments to the Claims:

1. (currently amended) A method for monitoring the operation of a continuous caster in a start-up casting mode in which molten metal is shaped in a continuous caster to form a solidifying strand product before the continuous caster reaches a predetermined minimum caster speed, the method including the following steps:

retrieving historical data consisting of multiple historical observations of process variables for a plurality of continuous caster start-up operations, the number of historical observations varying from one continuous caster start-up operation to another;

selecting a modelling set from said historical data to represent normal start-up operations of a continuous caster;

creating a synchronized data set of process trajectories from said modelling set in which the number of historical observations from each continuous caster start-up operation is scaled to correspond to a selected length of strand product;

performing a multi-way principal component analysis (MPCA) on said synchronized data set to calculate the value of principal components T and a loading matrix P for each continuous caster start-up operation to develop a multivariate statistical model of normal continuous caster start-up operations;

computing test statistics selected from the group consisting of Squared Prediction Error (SPE) and "Hotelling T" (HT) for each observation from said multivariate statistical model;

selecting control limits for said SPE and HT test statistics and their contributions;

acquiring on-line data consisting of multiple observations of said process variables observed at an elapsed time t during a start-up operation of a continuous caster;

predicting future process trajectories for said on-line data for a start-up operation of the continuous caster producing said selected length of strand product, historical data and on-line data being selected to correspond to a start-up operation having a casting speed of at least 0.1 meter/second;

applying said multivariate statistical model to a matrix X_{new} of said future process trajectories to compute test statistics selected from the group consisting of Squared Prediction Error (SPE) and "Hotelling T" (HT);

comparing said test statistics computed from the matrix X_{new} to the said control limits; and

generating a detection signal, said detection signal being indicative of whether the continuous caster start-up operation is consistent with normal start-up operations in a continuous caster.

2. (canceled)

3. (currently amended) A method according to Claim 1 ~~2~~ in which the historical data and on-line data are selected to correspond to a start-up operation having a cast length of strand product of up to 3.2 meters.

4. (original) A method according to Claim 1 in which the process variables are selected from the group comprising: mold thermocouple readings, temperature differences between pre-defined thermocouple pairs, stopper rod postion, tundish car net weight, mold cooling water flows, temperature difference between inlet and outlet mold cooling water, casting speed, and calculated heat flux transferred through each mold face.

5. (original) A method according to Claim 1 in which synchronization of process trajectories is based on non-uniform scales in the selected strand length whereby the MPCA calculation is performed more frequently at the beginning of a start-cast operation than at the end of the start-cast operation.

6. (original) A method according to Claim 5 in which the start-cast operation is selected to begin at a casting speed of 0.1 meter/second and to end at a casting length of 3.2 meters.

7. (original) A method according to Claim 1 in which the control limits are selected to exclude 5% of the continuous casting operations which represent normal start-up operations.

8. (original) A method according to Claim 1 in which the contribution of each process variable to SPE or HT at each observation in the strand length is calculated and control limits are selected to exclude 5% of the continuous casting operations which represent normal start-up operations.

9. (original) A method according to Claim 1 in which a number of multivariate statistical models are developed each corresponding to a range of continuous caster operating conditions selected from the group comprising: grade of metal being cast and width of casting strand.

10. (original) A method according to Claim 1 in which an alarm is generated to indicate an impending start-cast breakout or abnormal situation if the SPE or HT statistic of a new start-up operation exceeds its control limit over 3 consecutive sampling intervals.

11. (original) A method according to Claim 1 in which process variables are identified as the most likely causes of abnormal behaviour based on their contributions to the SPE and HT statistics.

12. (original) A method according to Claim 11 in which the likely root causes of abnormal behaviour are identified as the process variables that have the highest ratio of the SPE or HT contribution at a current observation and at a corresponding control limit.

13. (original) A method according to Claim 1 in which the control limits of SPE, HT and their contributions are updated from current operational data.

14. (original) A method according to Claim 1 in which future process trajectories are predicted based on the assumption that future deviations from average trajectories for process variables in the historical observations will remain constant.

15. (canceled)

16. (canceled)

17. (canceled)

18. (canceled)

19. (canceled)

20. (new) A method for monitoring a start-up operation of a continuous caster which begins with pouring liquid steel into an empty mould and ends when a cast length of strand product reaches a pre-determined length, the method including the following steps:

retrieving historical data consisting of multiple historical observations of process variables for a plurality of continuous caster start-up operations, the number of historical observations varying from one continuous caster start-up operation to another;

selecting a modelling set from said historical data to represent normal start-up operations of a continuous caster;

creating a synchronized data set of process trajectories from said modelling set in which the number of historical observations from each continuous caster start-up operation is scaled to correspond to a selected length of strand product;

performing a multi-way principal component analysis (MPCA) on said synchronized data set to calculate the value of principal components T and a loading matrix P for each continuous caster start-up operation to develop a multivariate statistical model of normal continuous caster start-up operations;

computing test statistics selected from the group consisting of Squared Prediction Error (SPE) and "Hotelling T" (HT) for each observation from said multivariate statistical model;

selecting control limits for said SPE and HT test statistics and their contributions;

acquiring on-line data consisting of multiple observations of said process variables observed at an elapsed time t during a start-up operation of a continuous caster;

predicting future process trajectories for said on-line data for a start-up operation of the continuous caster producing said selected length of strand product;

applying said multivariate statistical model to a matrix X_{new} of said future process trajectories to compute test statistics selected from the group consisting of Squared Prediction Error (SPE) and "Hotelling T" (HT);

comparing said test statistics computed from the matrix X_{new} to the said control limits; and

generating a detection signal, said detection signal being indicative of whether the continuous caster start-up operation is consistent with normal start-up operations in a continuous caster.

21. (new) A method according to Claim 20 in which the historical data and on-line data are selected to correspond to a start-up operation having a casting speed of at least 0.1 meter/second.

22. (new) A method according to Claim 21 in which the historical data and on-line data are selected to correspond to a start-up operation having a cast length of strand product of up to 3.2 meters.

23. (original) A method according to Claim 20 in which the process variables are selected from the group comprising: mold thermocouple readings, temperature differences between pre-defined thermocouple pairs, stopper rod postion, tundish car net weight, mold cooling water flows, temperature difference between inlet and outlet mold cooling water, casting speed, and calculated heat flux transferred through each mold face.

24. (new) A method according to Claim 1 in which synchronization of process trajectories is based on non-uniform scales in the selected strand length whereby the MPCA calculation is performed more frequently at the beginning of a start-cast operation than at the end of the start-cast operation.

25. (new) A method according to Claim 24 in which the start-cast operation is selected to begin at a casting speed of 0.1 meter/second and to end at a casting length of 3.2 meters.

26. (new) A method according to Claim 20 in which the control limits are selected to exclude 5% of the continuous casting operations which represent normal start-up operations.

27. (new) A method according to Claim 20 in which the contribution of each process variable to SPE or HT at each observation in the strand length is calculated and control limits are selected to exclude 5% of the continuous casting operations which represent normal start-up operations.

28. (new) A method according to Claim 20 in which a number of multivariate statistical models are developed each corresponding to a range of continuous caster operating

conditions selected from the group comprising: grade of metal being cast and width of casting strand.

29. (new) A method according to Claim 20 in which an alarm is generated to indicate an impending start-cast breakout or abnormal situation if the SPE or HT statistic of a new start-up operation exceeds its control limit over 3 consecutive sampling intervals.

30. (new) A method according to Claim 20 in which process variables are identified as the most likely causes of abnormal behaviour based on their contributions to the SPE and HT statistics.

31. (new) A method according to Claim 30 in which the likely root causes of abnormal behaviour are identified as the process variables that have the highest ratio of the SPE or HT contribution at a current observation and at a corresponding control limit.

32. (new) A method according to Claim 20 in which the control limits of SPE, HT and their contributions are updated from current operational data.

33. (new) A method according to Claim 20 in which future process trajectories are predicted based on the assumption that future deviations from average trajectories for process variables in the historical observations will remain constant.